

CLAIMS

1. A method of controlling wireless messaging in a worksite area (12), in which worksite management messages are received by, or sent from, communicating entities operating within said worksite, comprising the steps of:

- dividing at least part of said worksite area into elementary cells (C) mapped in correspondence with the topology of said area, or into said cells and determined communication zones (CZ),
- for a given cell or communication zone of said worksite, establishing at least one communication attribute value (C01-C03) pertaining to a parameter of wireless communication to or from said given cell or communication zone,
- for a given cell, establishing at least one worksite management attribute value (F01-F11, G01-G13, H01-H07, I0-I08) of the worksite for said given cell, said worksite management attribute value pertaining to a parameter other than a said communication attribute parameter,
- storing, in a memory (20), values of said worksite management and communication attributes, each stored attribute value being electronically indexed to the elementary cell, or to the communication zone, for which it was determined,
- forming a said worksite management message with an electronically readable content containing at least one worksite management attribute value,
- accessing said memory to obtain at least one current communication attribute value in respect of a cell or communication zone to or from which said formed management message is to be communicated by a wireless communication,

and

- establishing a wireless communication to or from said cell or communication zone to send or receive said management message on the basis of said current communication attribute value(s) electronically accessed from said memory.

2. Method according to claim 1, wherein said memory (20) is provided as a common resource whose contents are accessible to communicating parties exchanging worksite management messages.

3. Method according to claim 1 or 2, wherein said at least one communication attribute is one of the following attributes:

- i) a communication frequency or channel allocation,
- ii) a signal strength indicator, indicating a signal strength to use,
- iii) a bandwidth capacity indicator,
- iv) a detected signal-to-noise ratio,
- v) data communication security parameters, such as encryption/decryption codes, keys,
- vi) data messaging format information,
- vii) data transmission protocol information.

4. Method according to any one of claims 1 to 3, comprising the step of indexing in said memory worksite (20) management attributes and communication attributes to a common elementary cell to which they pertain.

5. Method according to any one of claims 1 to 4, further comprising the steps of:

- analysing a detected wireless communication signal at a determined elementary cell (C) or communication zone (CZ),
- determining, on the basis of said analysis, whether a value of a said communication attribute of that signal is appropriate under current wireless communication conditions,
- if said value of a said communication attribute is determined not to be appropriate, sending a message to said memory (20) to cause the value of said communication attribute to be updated to an appropriate value, or to adjust the value of another communication parameter.

6. Method according to claim 5, further comprising sending a message directly to the source of said detected wireless signal to cause said source to update the value of said communication attribute to an appropriate value or to adjust the value of another communication parameter.

7. Method according to any one of claims 1 to 6, wherein for at least one communication attribute, said memory (20) stores a plurality of values indexed as a function of at least one of:

- i) a classification of the wireless communication sending party,
- ii) a classification of the wireless communication receiving party,
- iii) a classification of a worksite management attribute to be conveyed in a said worksite management message,
- iv) a location of the wireless communication sending

party,

v) a location of the wireless communication receiving party.

8. Method according to any one claims 1 to 7, comprising the step of establishing or maintaining a radio link at a receiving party, comprising the sub-steps of:

- accessing at least one stored communication attribute value, and

- automatically configuring receiver means of said receiving party on the basis of a said accessed communication attribute value(s).

9. Method according to any one of claims 1 to 8, comprising the step of establishing or maintaining a radio link at a transmitting party, comprising the sub-steps of:

- accessing at least one stored communication attribute value, and

- automatically configuring transmitter means of said transmitting party on the basis of a said accessed communication attribute value(s).

10. Method according to any one of claims 1 to 9, wherein a said communication attribute is a radio frequency or channel allocation, for exchanging data with a remote resource, said method comprising the step of automatically updating and using said updated radio frequency or channel allocation as a function of communication conditions.

11. Method according to any of claims 1 to 10, wherein a

said communication attribute is signal strength indicator specifying a modulation or carrier signal strength value to use for a transmission in a communication link, said method comprising the steps of:

- detecting a received signal strength (SAn) at a receiving party,
- determining (S22) whether said received signal strength is below a threshold (LoLimSan),
- in the affirmative, sending (S23) a message by the receiving party to correspondingly update said signal strength indicator value in said memory (20) accessible to communicating parties.

12. Method according to any one of claims 1 to 11, wherein a said communication attribute is a bandwidth capacity parameter expressing the bandwidth capacity limit of a given carrier or channel over a given communication link, said method comprising the steps of:

- determining the current amount of occupied bandwidth of a given communication carrier or channel,
- comparing said current amount of occupied bandwidth with the bandwidth capacity limit, indicated by said bandwidth capacity parameter, for that given communication carrier or channel, to determine if a determined saturation criterion is reached,
- in the affirmative, sending a message to said memory (20) and/or to communicating parties concerned, requesting to use another carrier or channel.

13. Method according to any one of claims 1 to 12, wherein

said stored worksite and communication attribute parameter values are organised in a three-dimensional matrix of which the first and second dimensions map the topology of said worksite area (12) and define the locations of said elementary cells or communication zones, and the third dimension corresponds to the set of worksite management and communication attribute parameter(s).

14. Method according to any one of claims 1 to 13, wherein a said elementary cell is dimensioned as a function of at least one of:

- the variation in contour at said cell,
- the variation in contour at the immediate vicinity of said cell,
- the rate of variation with respect to position in the value of at least one data to be managed,
- the type of tool(s) scheduled to operate in the area occupied by said elementary cell.

15. Method according to any one of claims 1 to 14, wherein dimensions of elementary cells are variable over said worksite area (12).

16. Method according to any one of claims 1 to 15, wherein communication attribute and/or worksite management attribute values are acquired and communicated and/or stored by mobile apparatus (36) as they are conducting site modifying tasks on the worksite.

17. Method according to any one of claims 1 to 16, comprising the steps of:

- interrogating at least one source (54-60) of dynamically updatable data, on board mobile apparatus (36) active on said worksite, capable of delivering at least one current attribute parameter value for a communication attribute and/or for a worksite management attribute,
- determining the geographical location at which said current value(s) is/are acquired, and
- storing said attribute parameter value(s) acquired at said interrogating step, in association with the cell or communication zone corresponding to the said determined geographical location, as an updated communication attribute and/or a worksite management attribute parameter value.

18. Method according to claim 17, wherein a said updated communication attribute and/or worksite management attribute value is sent to a remote data management resource (18) for dynamically updating said stored data values by the steps of:

- forming a message containing said communication attribute and/or a worksite management attribute parameter value(s) and said geographical location data, and
- sending said message to said remote data management resource.

19. Method according to any one of claims 1 to 18, comprising the steps of:

- interrogating at least one source (54-60) of dynamically

updatable data on board said mobile apparatus (36), capable of delivering at least one current communication attribute and/or worksite management attribute parameter value,

- determining the geographical location at which said current value(s) is/are acquired,
- associating and locally storing said current communication attribute and/or worksite management attribute parameter value(s) and said geographical location data on board said mobile apparatus.

20. Method according to claim 19, further comprising the step of uploading said communication attribute and/or a worksite management attribute parameter value(s) and said geographical location data from said mobile apparatus to a remote data management resource at a determined updating moment.

21. Method according to any one of claims 1 to 20, wherein the value(s) of at least one said communication attribute and/or worksite management is/are dynamically updatable, and acquired and communicated on-the-fly by, and as, a mobile apparatus (34, RA1-RA4) performs worksite modifying tasks evolves over said worksite area (12).

22. Method according to any one of claims 1 to 21, wherein at least one worksite management attribute relates to physical or chemical material characteristics of said worksite and/or physical or chemical atmospheric characteristics of said worksite.

23. Method according to any one of claims 1 to 22, wherein at least one worksite management attribute parameter value is inferred from operating parameters of a site-modifying apparatus (36) operative in said worksite area.

24. Method according to any one of claims 1 to 23, wherein at least one worksite management attribute value is established prior to site modifying operations on said worksite and relates to a non-dynamic land characteristic of said worksite (12).

25. Method according to any one of claims 1 to 24, wherein said at least one worksite management attribute value is established prior to site modifying operations on said worksite and relates to operating characteristics of mobile apparatus (36).

26. Method according to any one of claims 1 to 25, wherein said at least one worksite management attribute value is established prior to site modifying operations on said worksite and relates to legal, administrative, or contractual data associated to said worksite.

27. Method according to any one of claims 1 to 26, wherein at least one worksite management attribute relates to a reference level, its value for a cell expressing reference level value with respect to which elevation/depth values are established for that cell.

28. Method according to any one of claims 1 to 27, further comprising the step of preparing an individualised dataset (70) specific to an identified site-modifying mobile apparatus (36), said individualised dataset comprising selected communication attribute and/or a worksite management attribute parameter values for the requirements of that site-modifying mobile apparatus.

29. Method according to claim 28, wherein said individualised dataset relates only to cells of a region (68) of said worksite where said site-modifying apparatus (36) is programmed to be present over a determined time window.

30. A system for controlling wireless messaging in a worksite area (12), in which worksite management messages are received by, or sent from, communicating entities operating within said worksite, at least part of said worksite area being divided into elementary cells (C) mapped in correspondence with the topology of said area, or being divided into said cells and determined communication zones (CZ), said system comprising:

- means for establishing, for a given cell or communication zone of said worksite, at least one communication attribute value (C01-C03) pertaining to a parameter of wireless communication to or from said given cell or communication zone,
- means for establishing, for a given elementary cell, at least one worksite management attribute value (F01-F011, G01-G13, H01-H07, I01-I08) of the worksite for said given cell, said worksite management attribute value pertaining to a parameter other than a said wireless communication parameter,

- memory means (20) for storing values of said worksite management and communication attributes, each stored attribute value being electronically indexed to the elementary cell, or to the communication zone, for which it was determined,
- means for forming a said worksite management message with an electronically readable content containing at least one worksite management attribute value,
- means for accessing said memory to obtain at least one current communication attribute value in respect of a cell or communication zone to or from which said formed management message is to be communicated by a wireless communication, and
- means for establishing a wireless communication to or from said cell or communication zone to send or receive said management message on the basis of said current communication attribute value(s) electronically accessed from said memory.

31. System according to claim 30, wherein said at least one communication attribute is one of the following attributes:

- i) a communication frequency or channel allocation,
- ii) a signal strength indicator, indicating a signal strength to use,
- iii) a bandwidth capacity indicator,
- iv) a detected signal-to-noise ratio,
- v) data communication security parameters, such as encryption/decryption codes, keys,
- vi) data messaging format information,
- vii) data transmission protocol information.

32. System according to claim 30 or 31, further comprising the steps:

- means for analysing a detected wireless communication signal at a determined elementary cell (C) or communication zone (CZ),
- means for determining, on the basis of said analysis, whether a value of a said communication attribute of that signal is appropriate under current wireless communication conditions, said determining means being responsive, if said value of a said communication attribute is determined not to be appropriate, to send a message to said memory (20) to cause the value of said communication attribute to be updated to an appropriate value, or to adjust the value of another communication parameter.

33. System according to claim 32, further comprising means for sending a message directly to the source of said detected wireless signal to cause said source to update the value of said communication attribute to an appropriate value or to adjust the value of another communication parameter.

34. System according to any one of claims 30 to 33, wherein for at least one communication attribute, said memory (20) stores a plurality of values indexed as a function of at least one of:

- i) a classification of the wireless communication sending party,
- ii) a classification of the wireless communication receiving party,

- iii) a classification of a worksite management attribute to be conveyed in a said worksite management message,
- iv) a location of the wireless communication sending party,
- v) a location of the wireless communication receiving party.

35. System according to any one claims 30 to 34, adapted to establish or maintain a radio link at a receiving party, said system comprising:

- means for accessing at least one stored communication attribute value, and
- means for automatically configuring receiver means of said receiving party on the basis of a said accessed communication attribute value(s).

36. System according to any one of claims 30 to 35, adapted to establish or maintain a radio link at a transmitting party, said system comprising:

- means for accessing at least one stored communication attribute value, and
- means for automatically configuring transmitter means of said transmitting party on the basis of said accessed communication attribute value(s).

37. System according to any one of claims 30 to 36, wherein a said communication attribute is a radio frequency or channel allocation, for exchanging data with a remote resource, said system comprising means for automatically updating and using said updated radio frequency or channel allocation as a function of '

communication conditions.

38. System according to any of claims 30 to 37, wherein a said communication attribute is signal strength indicator specifying a modulation or carrier signal strength value to use for a transmission in a communication link, said system comprising:

- means for detecting a received signal strength (SAn) at a receiving party,
- means for determining (S22) whether said received signal strength is below a threshold (LoLimSan) and, in the affirmative, for sending (S23) a message by the receiving party to correspondingly update said signal strength indicator value in said memory (20) accessible to communicating parties.

39. System according to any one of claims 30 to 38, wherein a said communication attribute is a bandwidth capacity parameter ¹⁵expressing the bandwidth capacity limit of a given carrier or channel over a given communication link, said system comprising:

- means for determining the current amount of occupied bandwidth of a given communication carrier or channel,
- means for comparing said current amount of occupied bandwidth with the bandwidth capacity limit, indicated by said bandwidth capacity parameter, for that given communication carrier or channel, to determine if a determined saturation criterion is reached and, in the affirmative, for sending a message to said memory (20) and/or to communicating parties concerned, requesting to use another carrier or channel.

40. System according to any one of claims 30 to 39, comprising means, aboard mobile apparatus (36) conducting site modifying tasks, adapted to acquire communication attribute and/or worksite management attribute values, and to communicate and/or store said values as said mobile apparatus is conducting site modifying tasks on the worksite.

41. System according to any one of claims 30 to 40, comprising:

- means for interrogating at least one source (54-60) of dynamically updatable data on board mobile apparatus (36) active on said worksite, said source being capable of delivering at least one current attribute parameter value for a communication attribute and/or for a worksite management attribute,

- means for determining the geographical location at which said current value(s) is/are acquired, and

- means for storing said attribute parameter value(s) acquired at said interrogating step, in association with the cell corresponding to the said determined geographical location, as an updated communication attribute and/or for a worksite management attribute parameter value.

42. System according to claim 41, further comprising means for sending said updated communication attribute and/or a worksite management attribute value to a remote data management resource (18) for dynamically updating said stored data values, said system comprising:

- means for forming a message containing said communication attribute and/or a worksite management attribute parameter value(s) and said geographical

location data, and

- means for sending said message to said remote data management resource.

43. System according to any one of claims 30 to 42, further comprising:

- means for interrogating at least one source (54-60) of dynamically updatable data on board said mobile apparatus (36), said source being capable of delivering at least one current communication attribute and/or a worksite management attribute parameter value,
- means determining the geographical location at which said current value(s) is/are acquired, and
- means for associating and locally storing said current communication attribute and/or a worksite management attribute parameter value(s) and said geographical location data on board said mobile apparatus.

44. System according to claim 43, further comprising means for uploading said communication attribute and/or a worksite management attribute parameter value(s) and said geographical location data from said mobile apparatus to a remote data management resource at a determined updating moment.

45. System according to any one of claims 30 to 44, wherein the value(s) of at least one said communication attribute and/or a worksite management is/are dynamically updatable, said system comprising means, aboard mobile apparatus (34, RA1-RA4), for acquiring and communicating attribute data on-the-fly as said mobile apparatus

performs worksite modifying tasks and evolves over said worksite area (12).

46. System according to any one of claims 30 to 45, further comprising means for acquiring worksite attribute parameter value(s), said means being at least one of:

- a total station type of surveying device,
- an aerial view sensor,
- a GPS (global positioning by satellite) device,
- An LPS (local positioning system).

47. System according to any one of claims 30 to 46, further comprising data filtering means for selecting, from the stored attribute values, those items of information relevant to at least one of:

- selected cells,
- selected site-modifying apparatus,
- selected tasks on said worksite,

and means for sending said filtered information to targeted recipients.

48. A storage medium containing an individualised dataset (70) specific to an identified site-modifying mobile apparatus (36), said individualised dataset being prepared specifically for the execution of the method according to any one claims 1 to 29, and comprising selected data elements of said attribute worksite management and/or communication attribute parameters for the specific requirements of that site-modifying mobile apparatus.

49. Storage medium according to claim 48, wherein said individualised dataset relates only to cells of a region (68) of said worksite where said contour-modifying apparatus (36) is programmed to be present over a determined time window.

50. Code executable by processor means, said code causing said processor means to carry out the method according to any of claims 1 to 29.